

Spectral study of active galaxies with IXO

K. Iwasawa
INAF - OA Bologna

What to do with increased throughput

- Mapping the accretion flow near the black hole
- Fine line-spectroscopy of faint sources

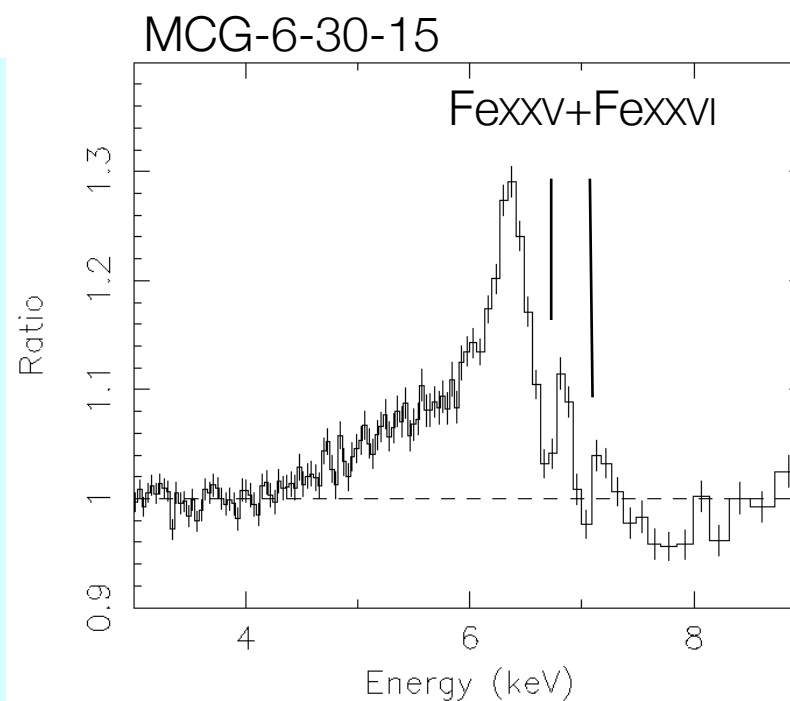
Relativistic effects due to strong gravity

Black hole spin

Real difficulty is the continuum subtraction

We need ...

- Hard band continuum (> 10 keV)
- Correction for absorption features at energies of the red wing
- Correction for absorption lines/edges of high-ionisation Fe K
- Good models of ionised absorber



Response of relativistic lines

Reverberation

- ★ Still difficult for Fe K
 - Selecting AGN with larger BH mass is equivalent to increasing effective area
- ★ Possible for Fe L (Fabian's talk)

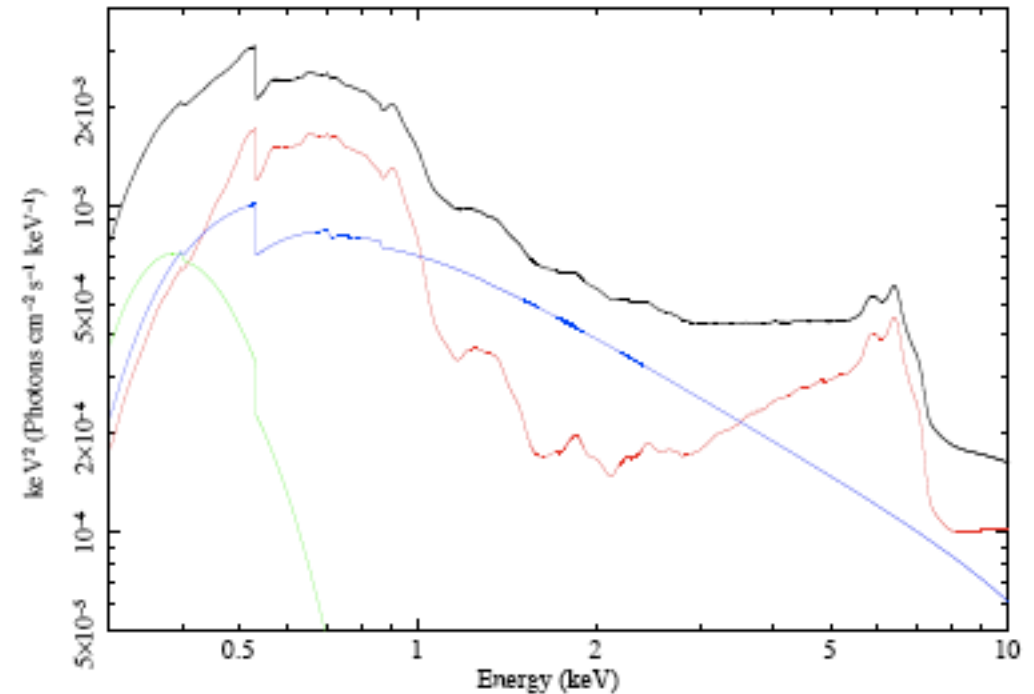
Orbital motion

- ★ Variation on dynamical time-scale is within a good reach

A few 10 ks for $10^7 M_{\text{sun}}$

Recent development on 1H0707-495

- Fe L bump lags behind the power-law by 30 s
- Reflection-dominated spectrum
- Strong light bending effects required



Fabian et al 09

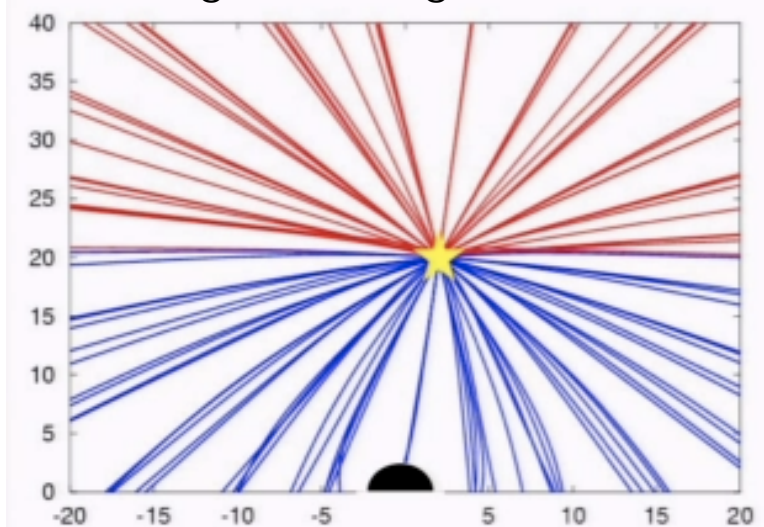
Implications

X-ray source is essentially anisotropic

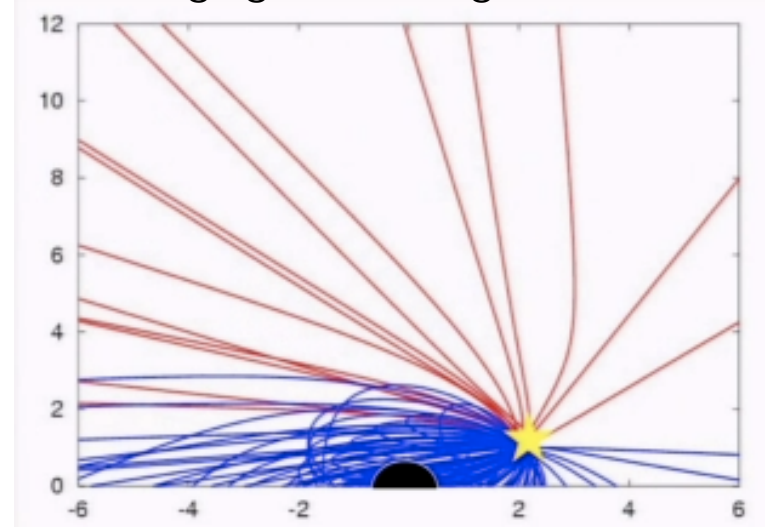


- Illuminating (apparent) luminosity vs. reprocessed luminosity, (e.g, X-ray vs FIR)
- Viewing angle dependence (e.g., Sy1 vs Sy2)

Little light-bending



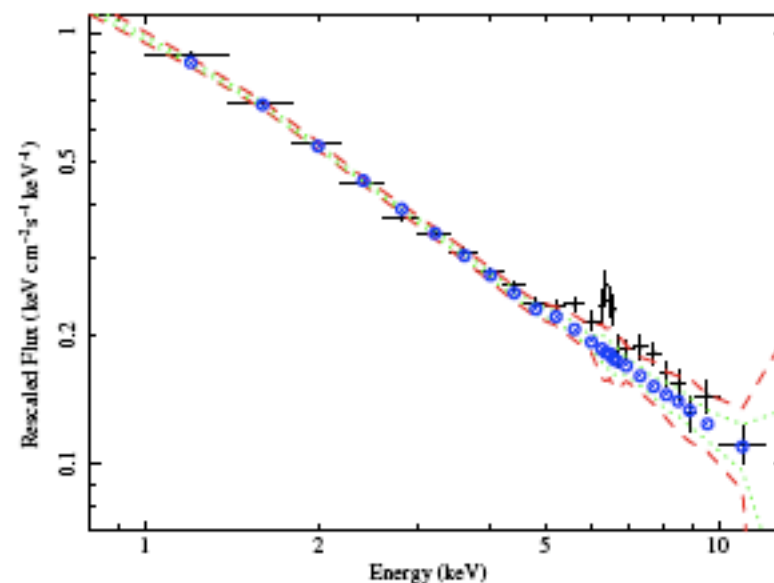
Strong light-bending



Relativistic lines: how common?

- ◆ 1/4 - 1/3 of nearby bright AGN
 - FEROS (Guainazzi, Longinotti et al)
 - Nandra et al (2007)
- ◆ No strong evidence of broad red wing in the mean spectrum of distant/faint objects

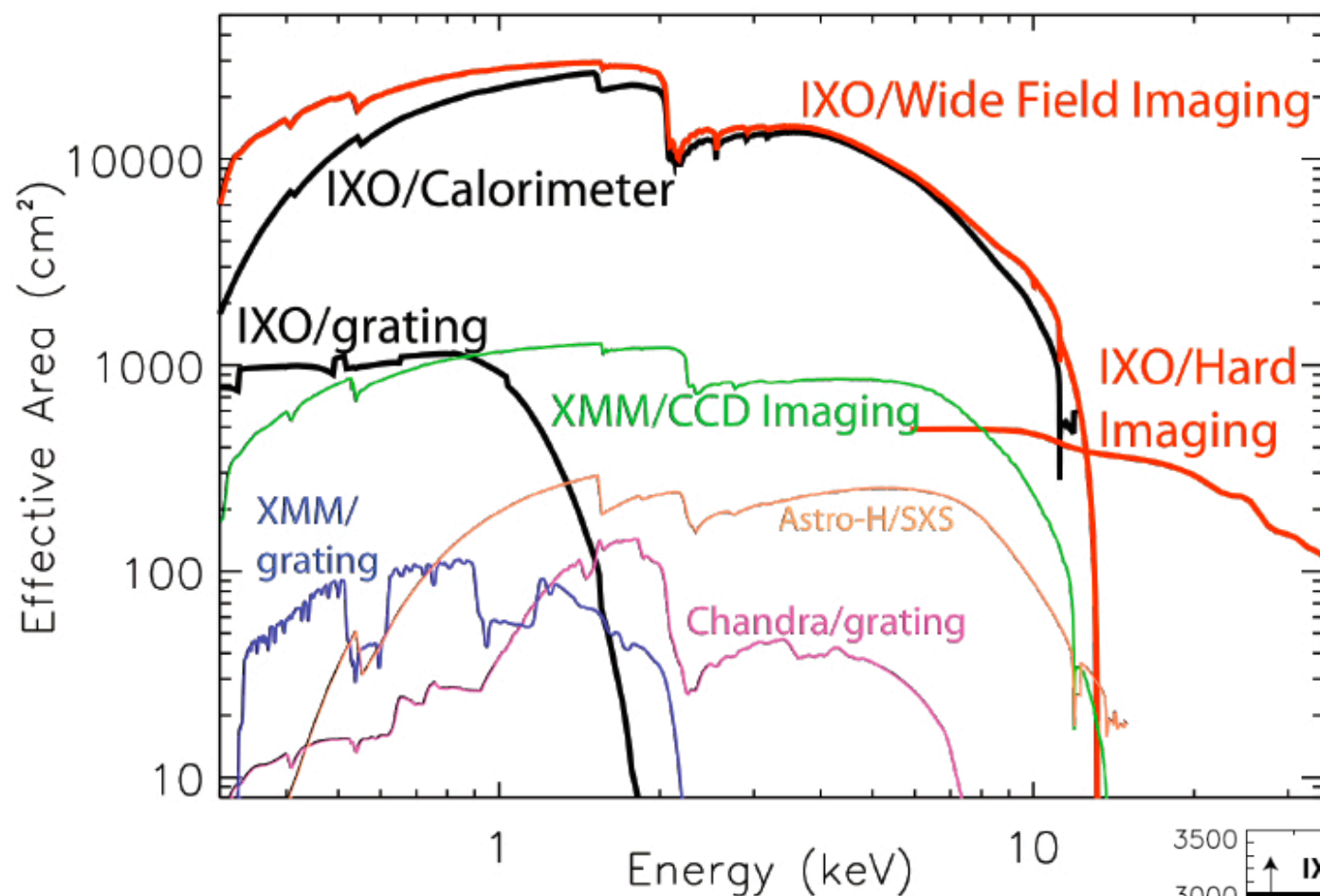
Corral et al 2008



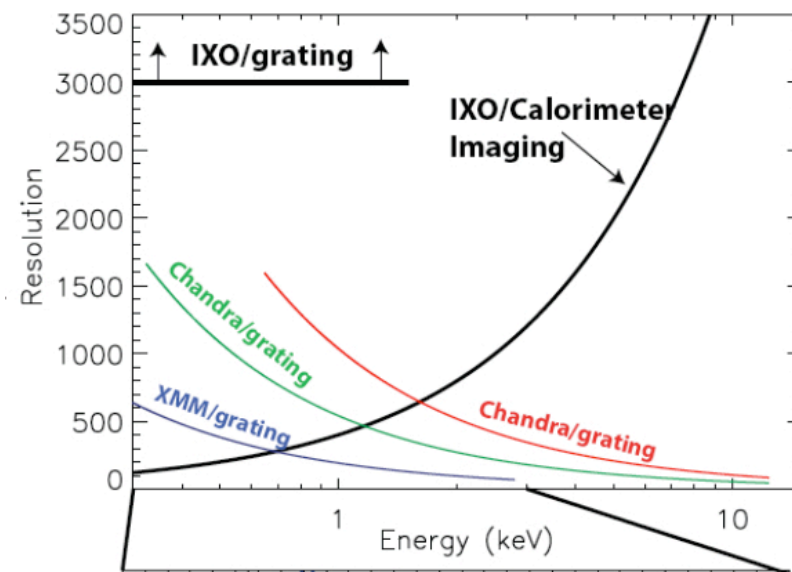
Benefits from high spectral resolution capability

Band	Area	vs	Remark
Above 2 keV	x300	CXO	S, Ar, Ca, Fe lines + RRC
1-2 keV	x100	RGS	Mg, Si
Below 1 keV	x10	RGS	far better resolution with grating

Effective area



Resolution



from the IXO website

Soft X-ray diagnostics of AGN vs starburst

Soft X-ray spectrum of strongly absorbed AGN

Limited resolution of CCD spectra



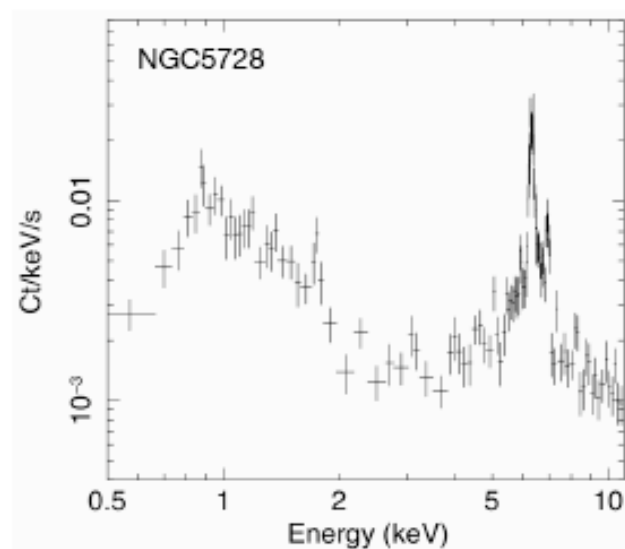
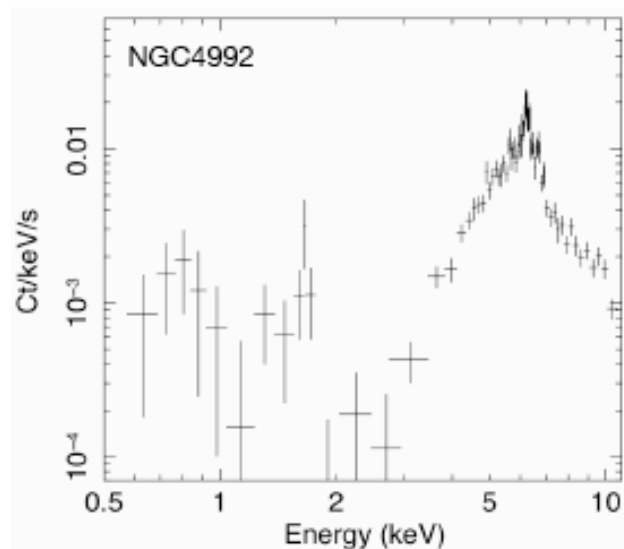
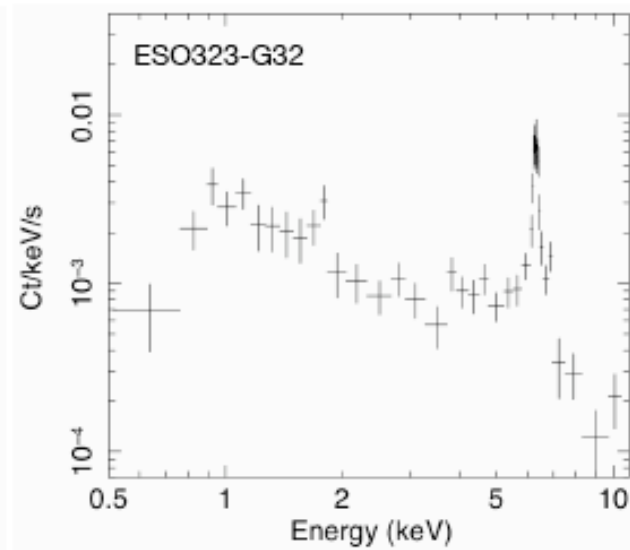
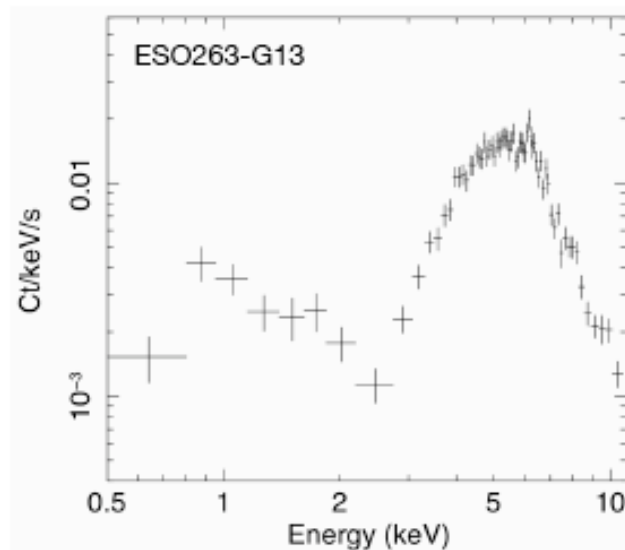
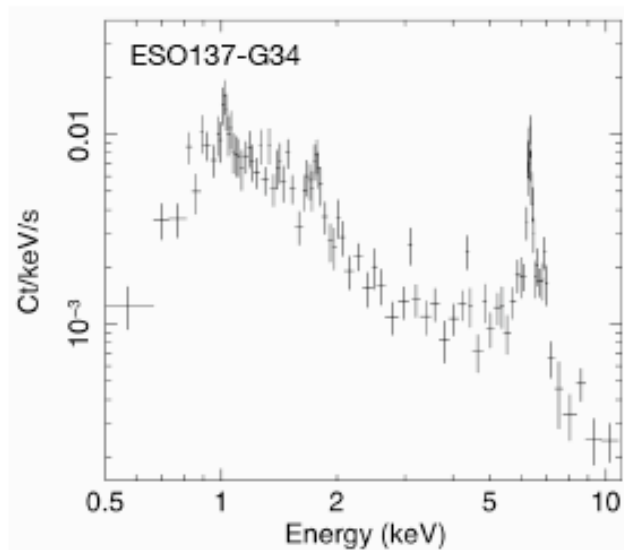
Heavy blending of emission-lines



Most frustrating problem

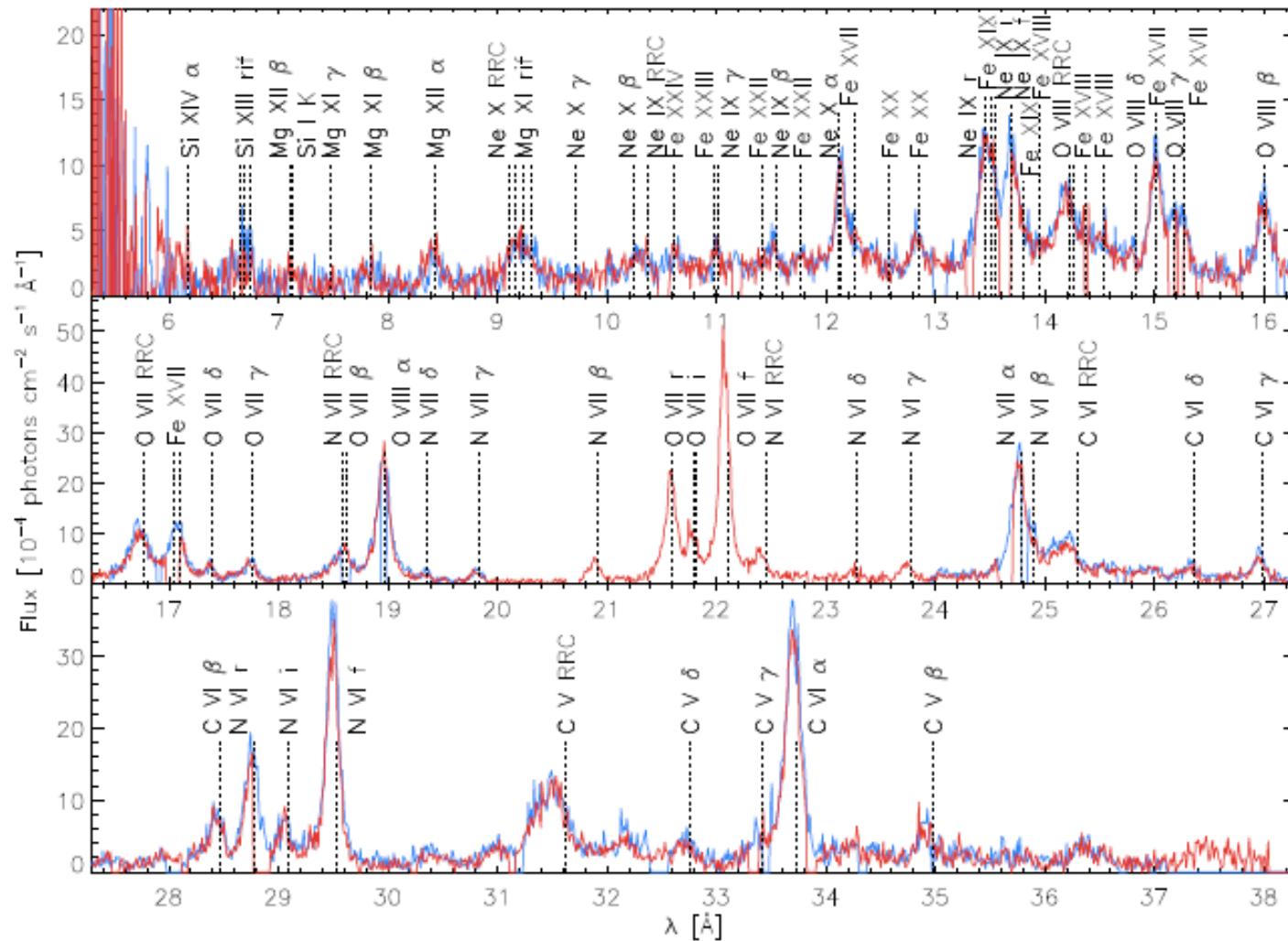
e.g., AGN or starburst in ULIRGs

Suzaku XIS spectra of obscured AGN



Comastri et al 09

RGS spectrum of NGC1068



Kinkhabwala et al 2002

Issue of scattering fraction in absorbed AGN

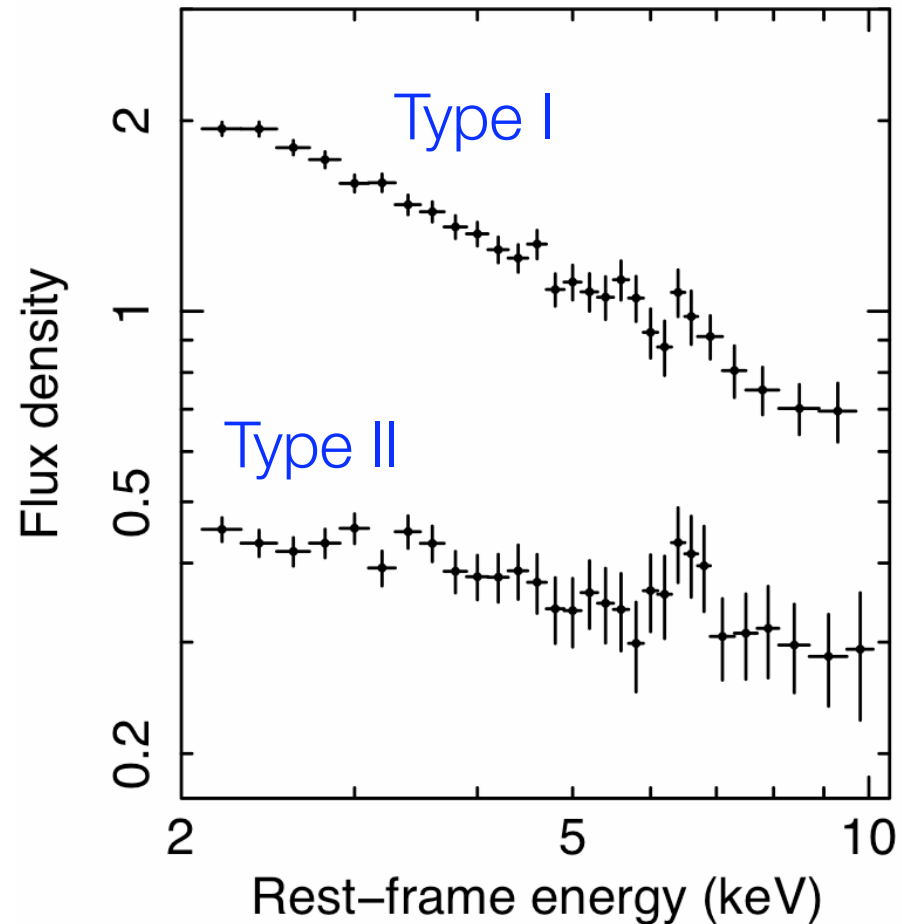
- Derived from fitting [CCD spectra](#)
- Fitting emission-line blend, not the (very weak) scattered continuum [see RGS spectra](#)

Separating the emission features from the continuum is necessary.

Spectra of faint source populations

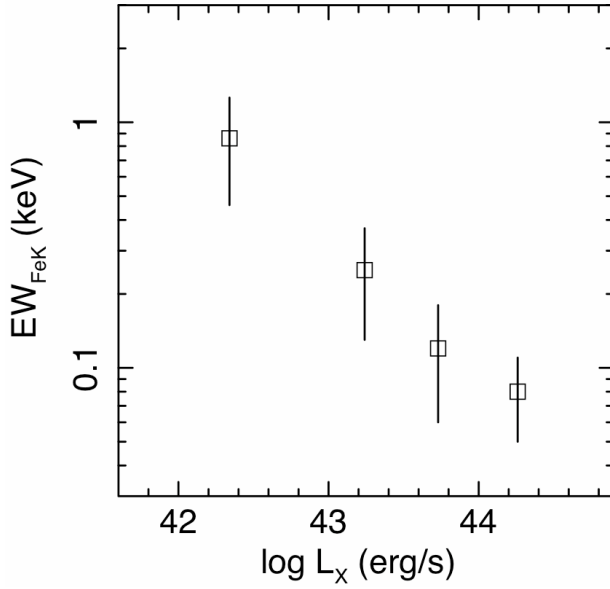
- ★ Individual spectra of distant, faint sources

Integrated spectra of
XMM-COSMOS sources



Type II AGN

in four L_X ranges



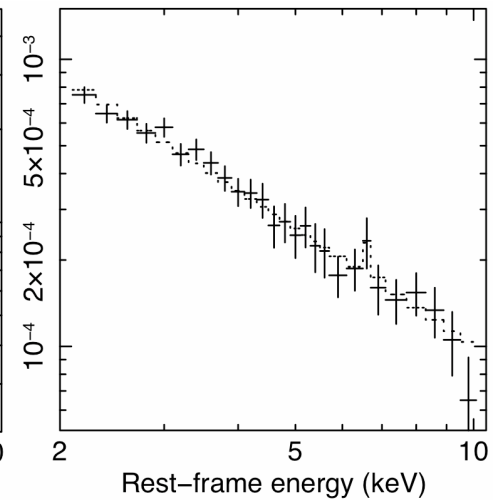
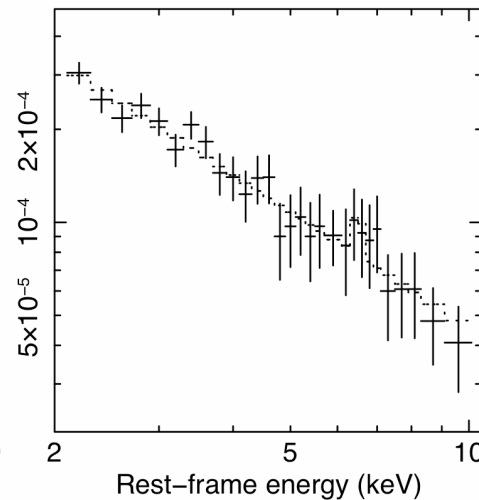
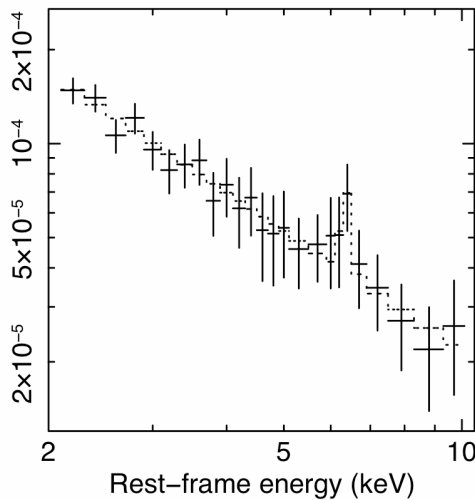
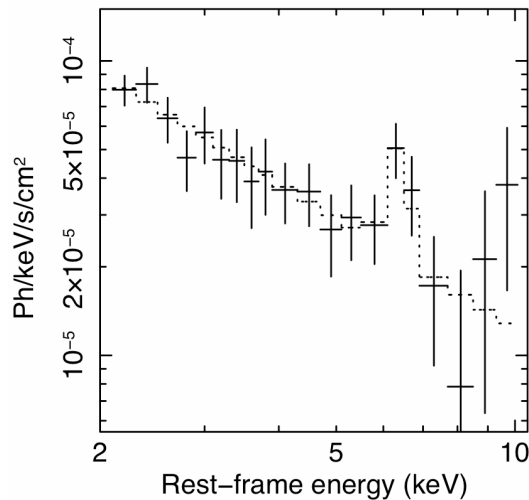
Very strong Fe K line in the lowest luminosities



Substantial number of heavily obscured AGN



Higher L_X



Suzaku data

